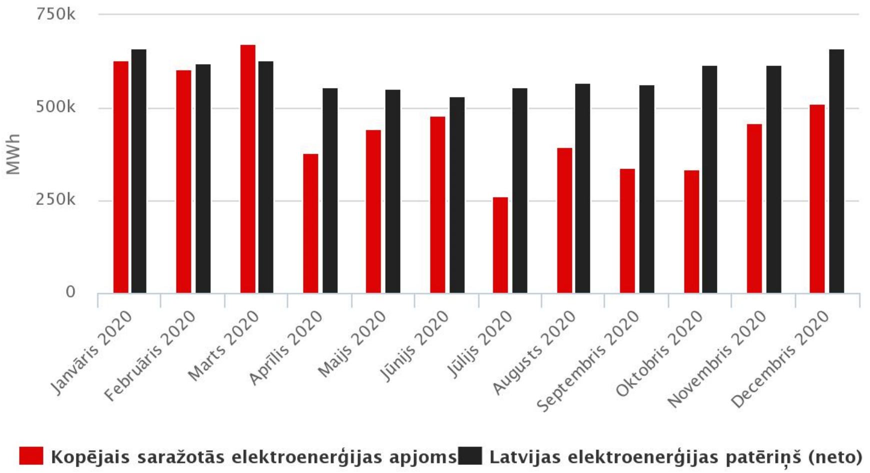
ENERĢIJA

Nākotnes enerģijas avoti ilgtspējīgām kopienām:
ūdeņraža tehnoloģiju attīstība.

Kaspars Liepiņš
18.03.2022

ELEKTROENERĢIJAS IZCELSME LV

Latvijas saražotās un patērētās elektroenerģijas 12 mēnešu
SALDO – 1 625 635 MWh (iztrūkums)



AS «Augstsprieguma tīkls» (AST) mājas lapa (https://ast.lv/lv/electricity-market-review?year=2020&month=13)

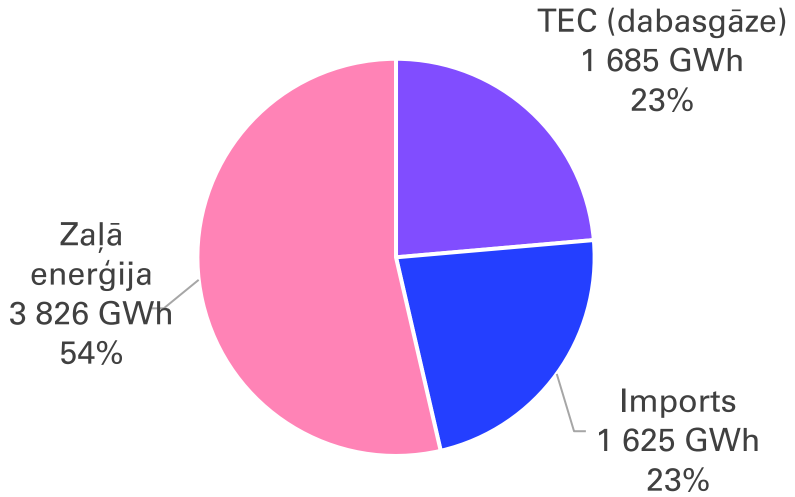
TEC elektroenerģijas izstrāde

1 685 GWh

2020.gads	GWh
TEC-1	364
TEC-2	1321

AS «Latvenergo» mājas lapa (https://latvenergo.lv/lv/par-mums/razosana)

Patērētās elektroenerģijas izcelsme (2020.g.)



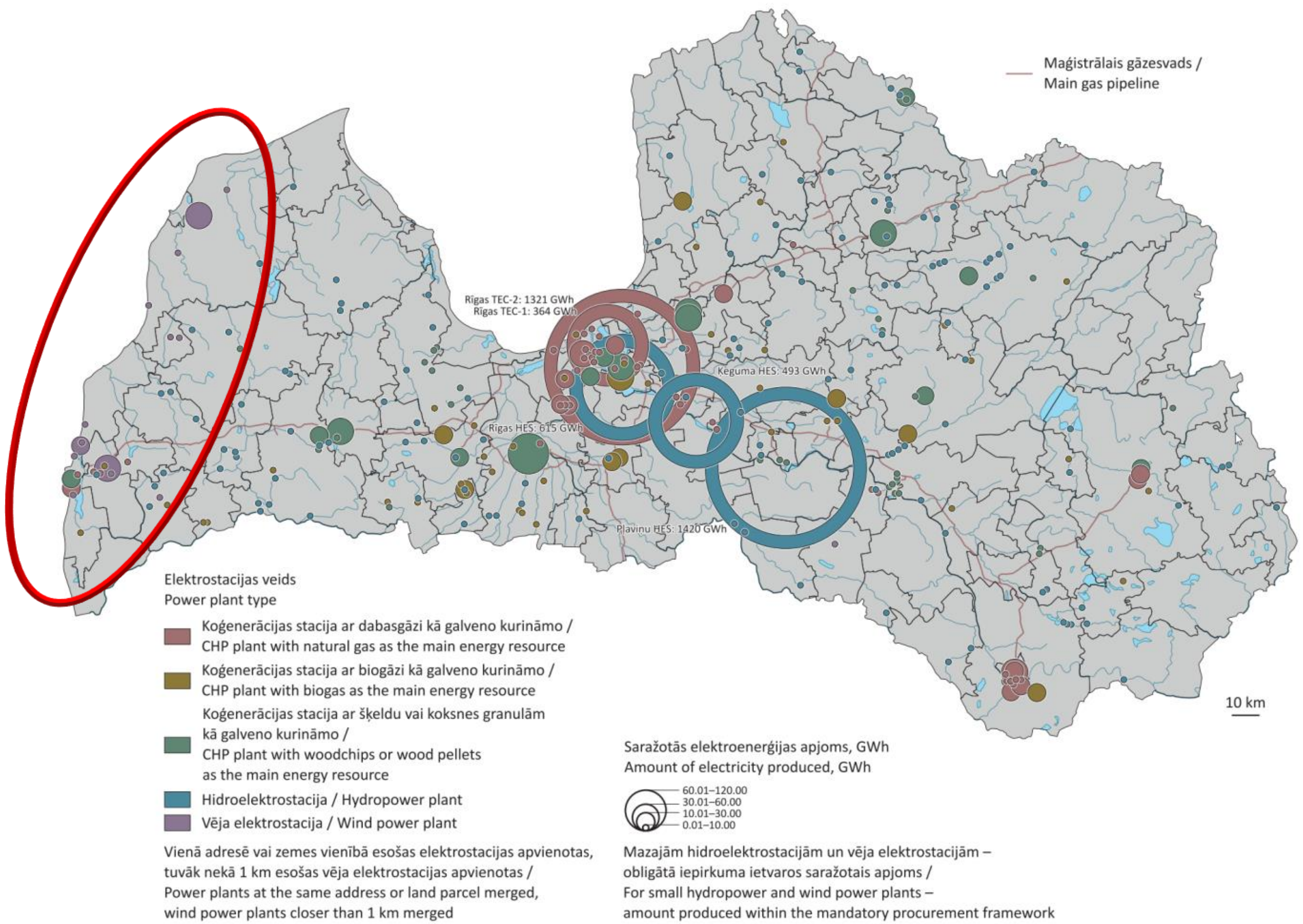
1 626 GWh (imports)

+ 1 685 GWh (fosilā d.g.)

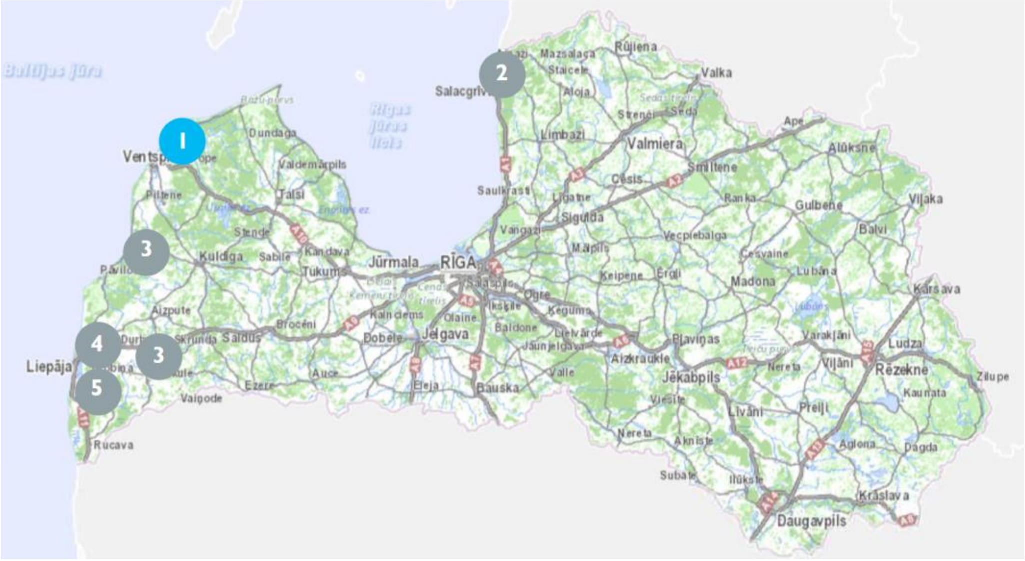
3 310 GWh «deficīts»

ELEKTROENERĢIJAS IZCELSME LV

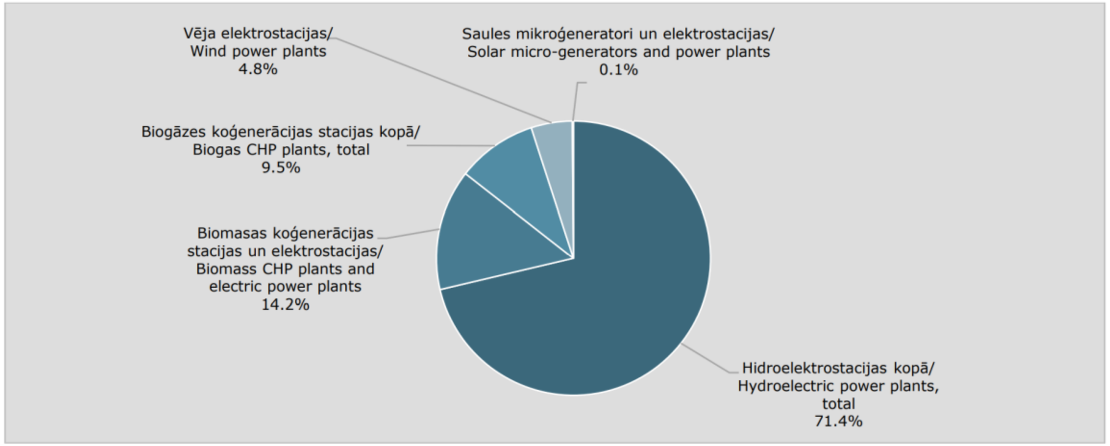
9.34. Saražotā elektroenerģija; 2020
9.34. Produced electricity; 2020



Latvijas statistikas gadagrāmata, 2021 (https://stat.gov.lv/lv/statistikas-temas/valsts-ekonomika/ikp-gada/publikacijas-un-infografikas/7251-latvijas-statistikas?themeCode=IR)



9.29. Saražotā elektroenerģija no atjaunīgiem energoresursiem (%); 2020
9.29. Share of renewable energy in gross final energy consumption (%); 2020



KO DARĪT?

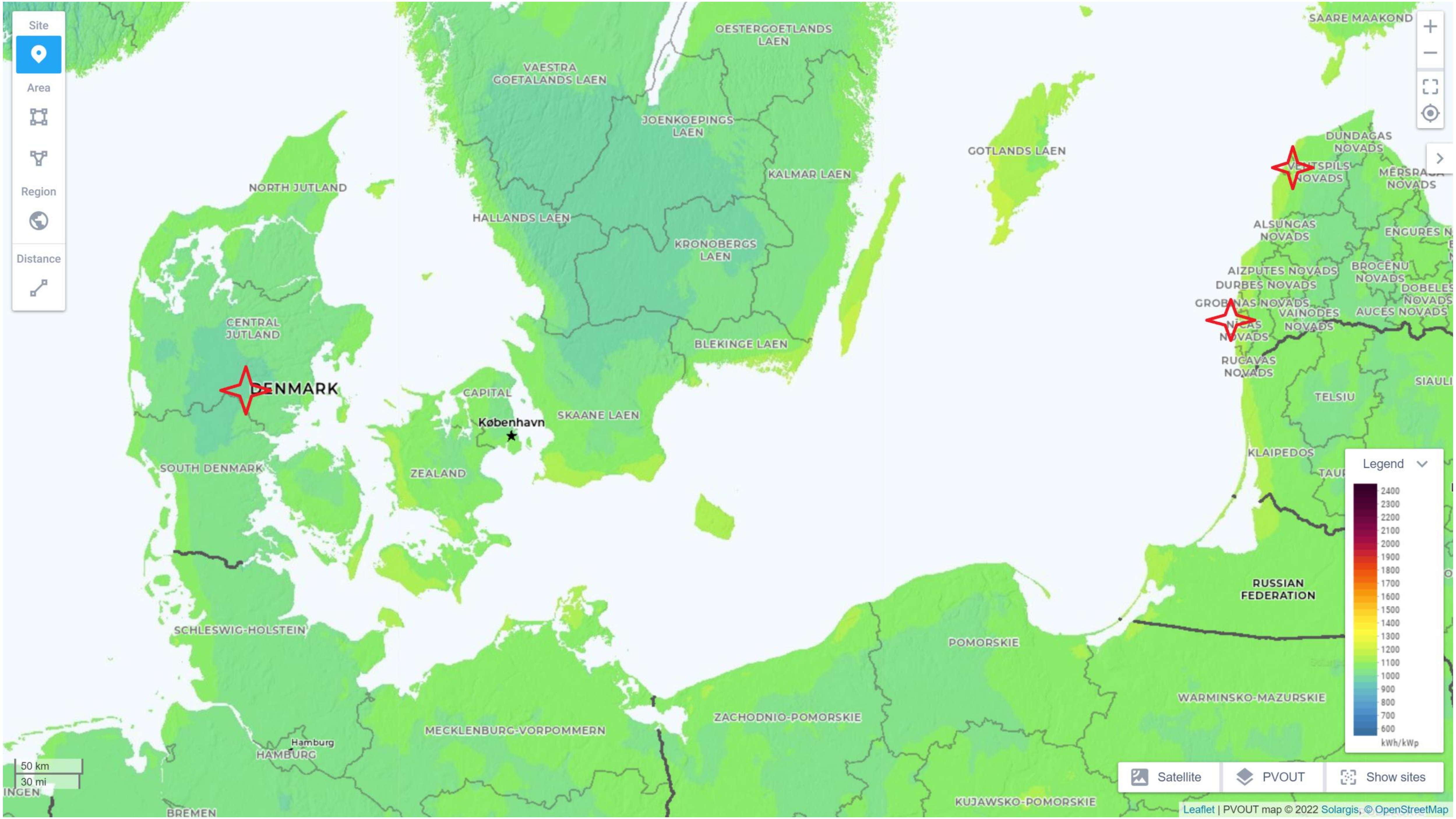
VANDEL III – SAULES PARKS JUTLANDĒ (DĀNIJA)

- Teritorija **180 ha** (~250 futbola lauk.)
- **> 500 000** PV paneļu
- PV jauda: **160 MW**
- AEP: 152 000 MWh/a = **152 GWh/a**
- Būvniecība 01/2020 – 12/2021
- **100%** no subsīdījām brīvs projekts
- **34 000** mājsaimniecību el. patēriņš
- **200 000** tCO2 samazinājums

https://vimeo.com/610498642

VANDEL III

https://vimeo.com/610498642


Site
Area
Region
Distance
OESTERGOETLANDS LAEN
VAESTRA GOETALANDS LAEN
JOENKOEPINGS LAEN
KALMAR LAEN
GOTLANDS LAEN
SAARE MAAKOND
DUNDAGAS NOVADS
VENTSPILS NOVADS
MERSRAGA NOVADS
NORTH JUTLAND
HALLANDS LAEN
KRONOBERGS LAEN
ALSUNGAS NOVADS
ENGURES N
AIZPUTES NOVADS
BROCENU NOVADS
DURBES NOVADS
DOBELES NOVADS
GROBINAS NOVADS
VAINODES NOVADS
AUCES NOVADS
NICAS NOVADS
CENTRAL JUTLAND
BLEKINGE LAEN
RUCAVAS NOVADS
DENMARK
CAPITAL
SIAULI
TELSIU
København
SKAANE LAEN
KLAIPEDOS
SOUTH DENMARK
ZEALAND
Legend
2400
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
kWh/kWp
RUSSIAN FEDERATION
SCHLESWIG-HOLSTEIN
POMORSKIE
WARMINSKO-MAZURSKIE
ZACHODNIO-POMORSKIE
MECKLENBURG-VORPOMMERN
Hamburg
HAMBURG
50 km
30 mi
BREMEN
KUJAWSKO-POMORSKIE
Satellite
PVOUT
Show sites
Leaflet | PVOUT map © 2022 Solargis, © OpenStreetMap

KO DARĪT?

VĒJA ENERĢIJA (VENTSPILS PUSĒ)

Winergy

- Vēja turbīnas: 9 x 2.3 MW (**20.7 MW**)
- AEP: no **45** līdz **63** GWh/a (vidēji **53 GWh/a**)
- Vidējā pilnās noslodze: 2640 h/a
- Darbības sākums: 2012

Tārgale (Utilitas)

- Vēja turbīnas: 14 x4.2 MW (**58.8** MW)
- AEP: **155 GWh/a**
- **50 000** mājsaimniecību el. pat.
- Darbības sākums: 2022 (plānots)

Back to report | PRODUCTION MWH

Month	2015	2016	2017	2018	2019	2020	2021	Total
January	7,527	4,550	5,564	5,005	4,413	8,390	3,366	**38,814**
February	5,120	4,802	4,230	2,359	6,410	7,638	3,444	**34,003**
March	5,888	2,381	5,500	3,882	6,917	6,477		**31,045**
April	4,676	4,683	3,656	4,369	4,651	4,971		**27,005**
May	4,633	2,381	2,454	2,601	4,177	4,493		**20,739**
June	4,055	3,660	4,512	3,564	2,877	2,295		**20,964**
July	4,426	2,978	2,991	2,318	3,325	4,608		**20,646**
August	2,887	4,646	4,491	3,080	2,681	2,000		**19,785**
September	3,184	2,700	4,075	6,371	5,085	5,274		**26,689**
October	3,116	6,432	6,423	5,455	4,995	5,370		**31,791**
November	5,898	5,187	4,403	3,169	3,804	6,349		**28,809**
December	8,421	7,533	6,514	3,430	6,966	5,458		**38,321**
Total	**59,831**	**51,933**	**54,814**	**45,603**	**56,300**	**63,323**	**6,809**	**338,612**

CIK AER VAJADZĒTU?

3 310 GWh ÷ 152 GWh = ~**22** Vandel III PV parki
- 180 ha x 22 = **3 960 ha**

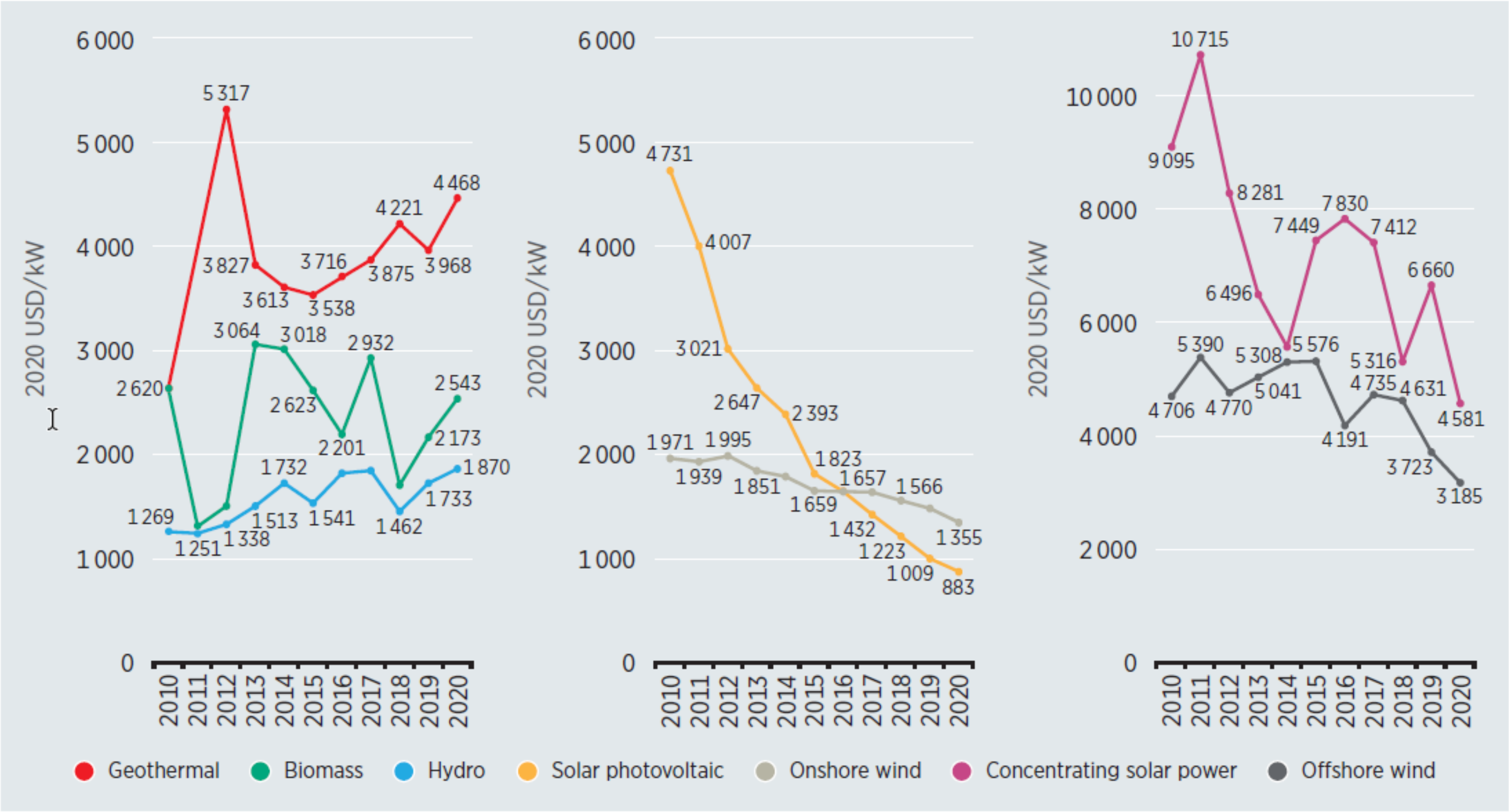
3 310 GWh ÷ 53 GWh = ~**62** Winergy Vēja parki
- **558** (2,3 MW turbīnas)

vai

3 310 GWh ÷ 155 GWh = ~**22** Utilitas «Tārgale» Vēja parki
- **308** (4,2 MW turbīnas)

UN CIK TAS MAKSĀ?

Figure 1.4 Global weighted-average total installed costs by technology, 2010-2020



Source: IRENA Renewable Cost Database

KAPITĀLIZMAKSAS 2020.gadā

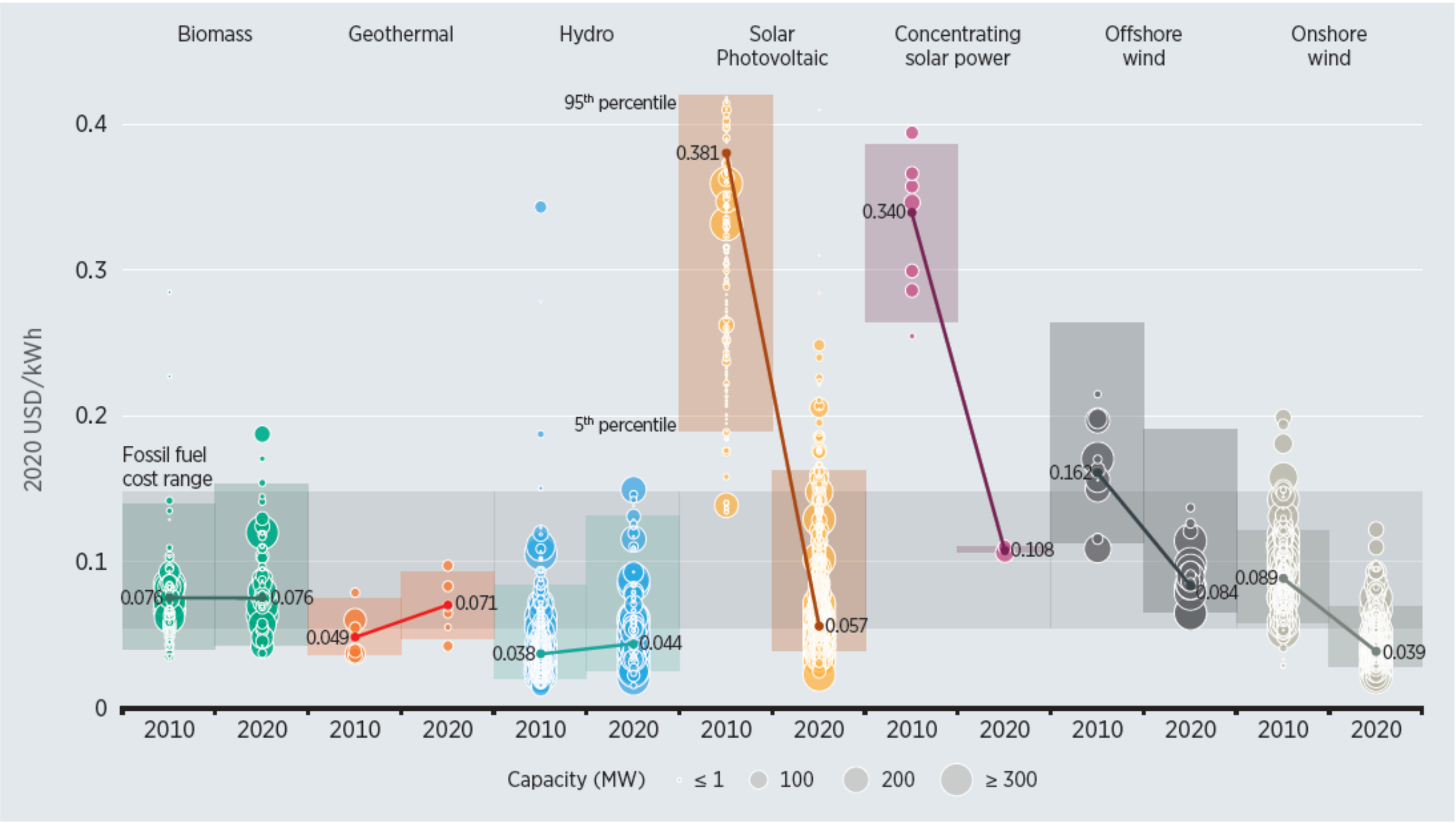
(USD/kW)

Saule (CSP)	-	4 581
Ģeotermālie	-	4 468
Vējš (atkrastes)	-	3 185
Biomasa	-	2 543
Hidro	-	1 870
Vējš (krasta)	**-**	**1 355**
Saule (PV)	**-**	**883**

International Renewable Energy Agency (IRENA) (**https://www.irena.org/publications/2021/Jun/Renewable-Power-Costs-in-2020**)

UN CIK TAS MAKSĀ?

Figure 1.2 Global LCOEs from newly commissioned, utility-scale renewable power generation technologies, 2010-2020



Source: IRENA Renewable Cost Database

LCOE 2020.gadā (USD/kWh)		
Saule (CSP)	-	0.108
Vējš (atkrastes)	-	0.084
Biomasa	-	0.076
Ģeotermālie	-	0.071
Saule (PV)	-	0.057
Hidro	**-**	**0.044**
Vējš (krasta)	**-**	**0.039**

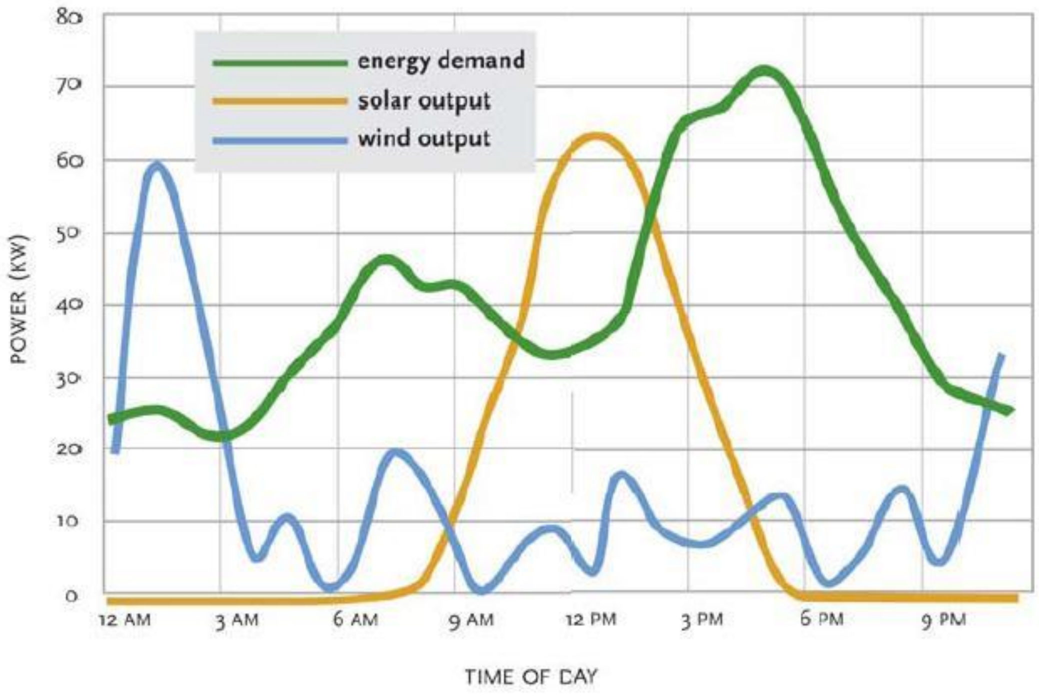
International Renewable Energy Agency (IRENA) (**https://www.irena.org/publications/2021/Jun/Renewable-Power-Costs-in-2020**)

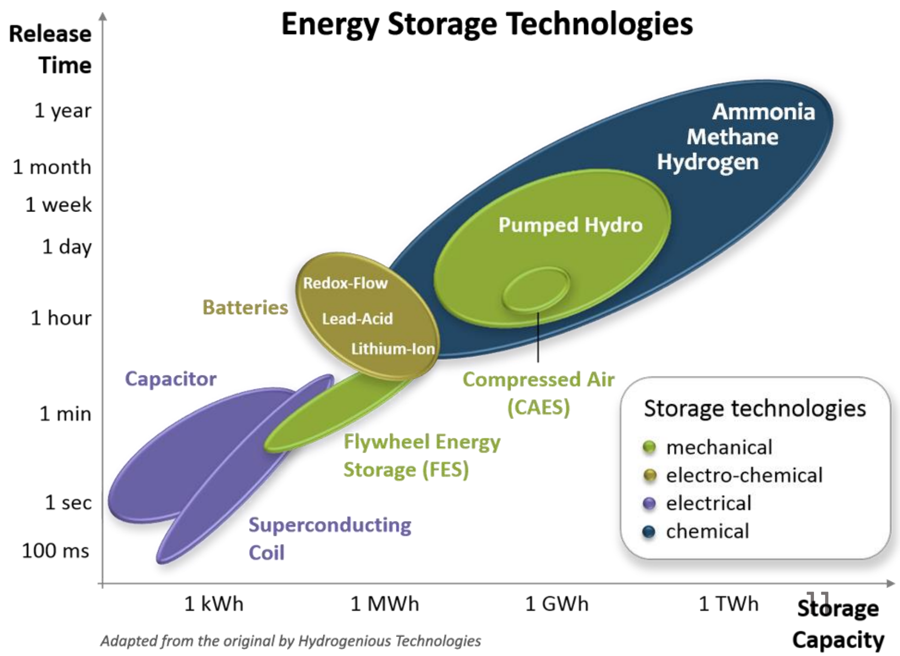
AER IZAICINĀJUMI

Figure 1 – Sample overview of storage technologies

	ELECTRICAL		MECHANICAL			ELECTROMECHANICAL			CHEMICAL	THERMAL
	Supercapacitors	SMES	PHS	CAES	Flywheels	Sodium Sulfur	Lithium Ion	Redox Flow	Hydrogen	Molten Salt
Maturity	Developing	Developing	Mature	Mature	Early commercialised	Commercialised	Commercialised	Early commercialised	Demonstration	Mature
Efficiency	90-95%	95-98%	75-85%	70-89%	93-95%	80-90%	85-95%	60-85%	35-55%	80-90%
Response Time	ms	<100 ms	sec-mins	mins	ms-secs	ms	ms-secs	ms	secs	mins
Lifetime, Years	20+	20+	40-60	20-40	15+	10-15	5-15	5-10	5-30 years	30 years
Storage duration*	min - hr	ms - min	4 - 20hr	4 - 30hr	s - hr	min - 8hr	<8hr	<10hr	up to months	hr
Discharge time	ms - 60 min	ms - 8 s	1 - 24 hs+	1 - 24 hs+	ms - 15 min	s - hr	min - hr	s - hr	1 - 24 hs+	min - hr
Environmental impact	None	Moderate	Large	Large	Almost none	Moderate	Moderate	Moderate	Dependent of H2 production method	Moderate

https://www.worldenergy.org/assets/downloads/ES_Five_Steps_to_Energy_Storage_-_ENGLISH.pdf





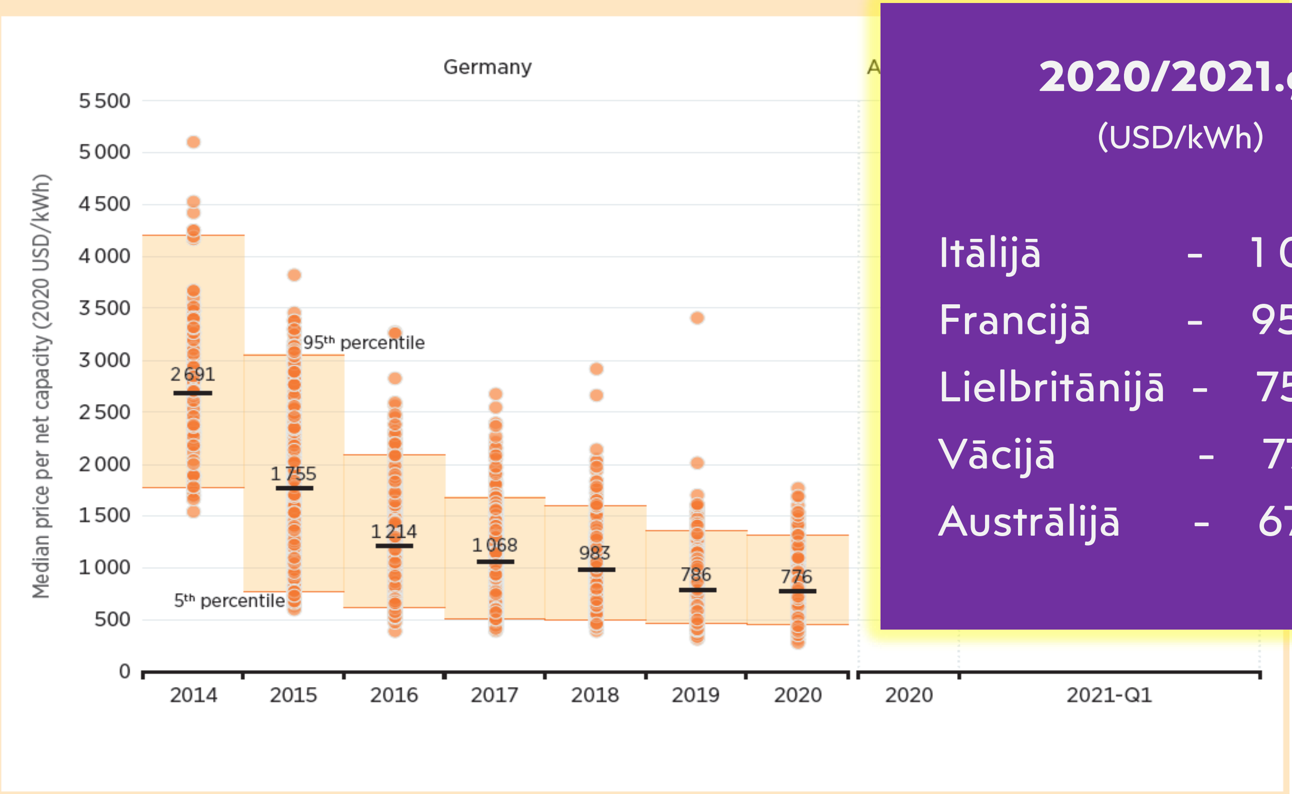
UN CIK TAS MAKSĀ?

Table 4 Energy Installation Cost (USD/kWh) per Storage Type, (IRENA, 2017)

Type	Technology	Year	Energy Installation Cost (USD/kWh) Worst	Reference	Best
Flow	VRFB	2016	1050	347	315
		2030	360	119	108
	ZBFB	2016	1680	900	525
		2030	576	309	180
High-Temperature	NaNiCl	2016	488	399	315
		2030	197	161	127
	NaS	2016	735	368	263
		2030	324	162	116
Lead-acid	Flooded LA	2016	473	147	105
		2030	237	74	53
	VRLA	2016	473	263	105
		2030	237	132	53
Li-ion	LFP	2016	840	578	200
		2030	326	224	77
	LTO	2016	1260	1050	473
		2030	574	478	215
	NCA	2016	840	352	200
		2030	347	145	82
	NMC/LMO	2016	840	420	200
		2030	335	167	79
Mechanical	CAES	2016	84	53	2
		2030	71	44	2
	Flywheel	2016	6000	3000	1500
		2030	3917	1959	979
	PHS	2016	100	21	5
		2030	100	21	5

https://www.worldenergy.org/assets/downloads/Five_steps_to_energy_storage_v301.pdf

Figure B3.1 Behind-the-meter residential lithium-ion battery system prices in Germany, Australia, France, Italy and the United Kingdom, 2014-2020



2020/2021.g.

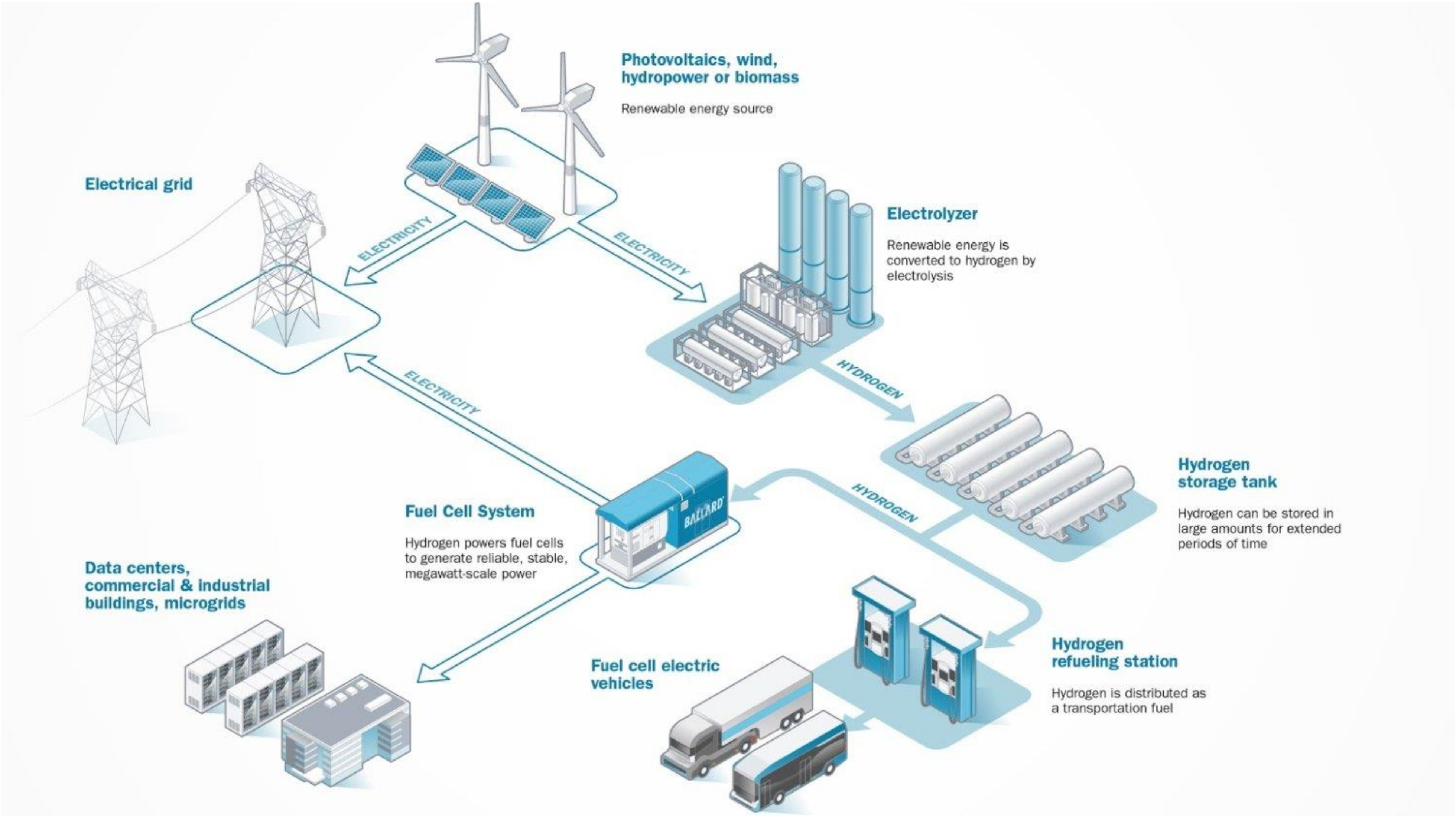
(USD/kWh)

Itālijā - 1 069
Francijā - 955
Lielbritānijā - 752
Vācijā - 776
Austrālijā - 670

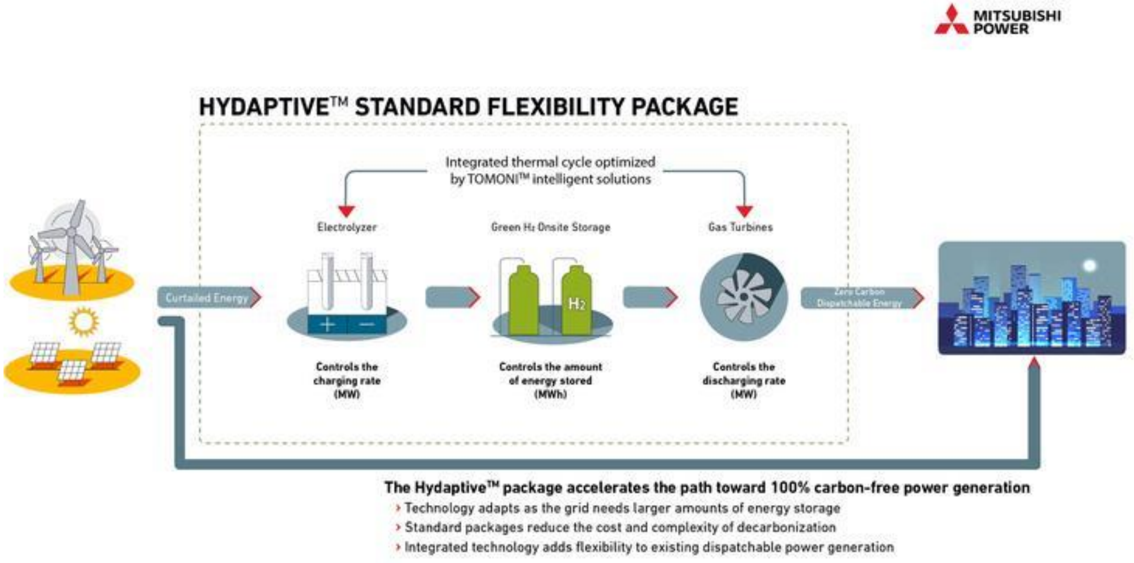
Source: IRENA and EUPD Research GmbH, 2021; and Solar Choice, 2021

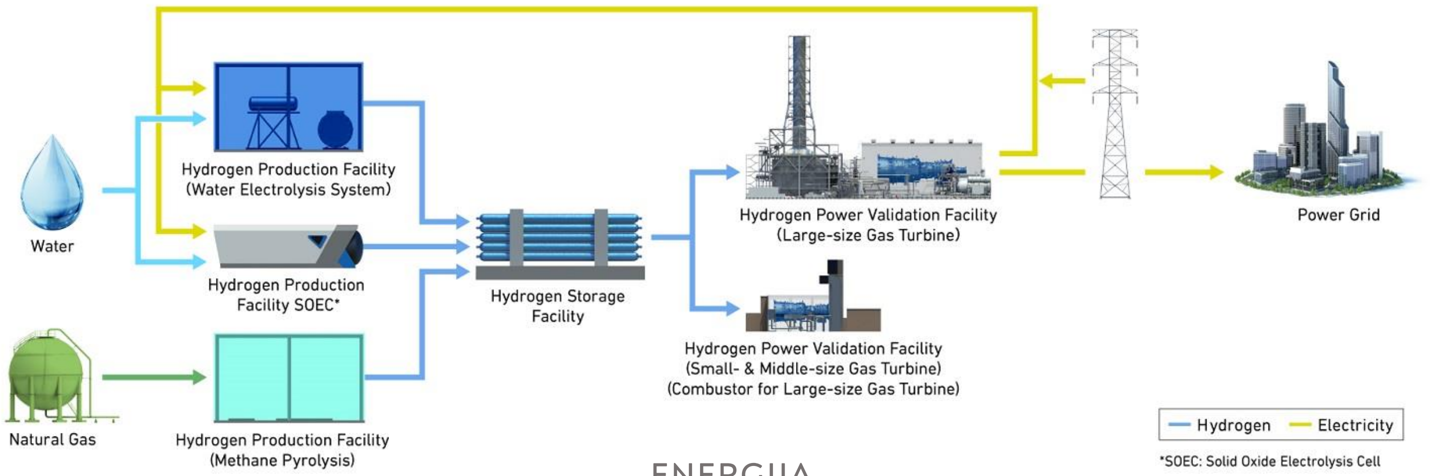
International Renewable Energy Agency (IRENA) (https://www.irena.org/publications/2021/Jun/Renewable-Power-Costs-in-2020)

ŪDEŅRAŽA RISINĀJUMI

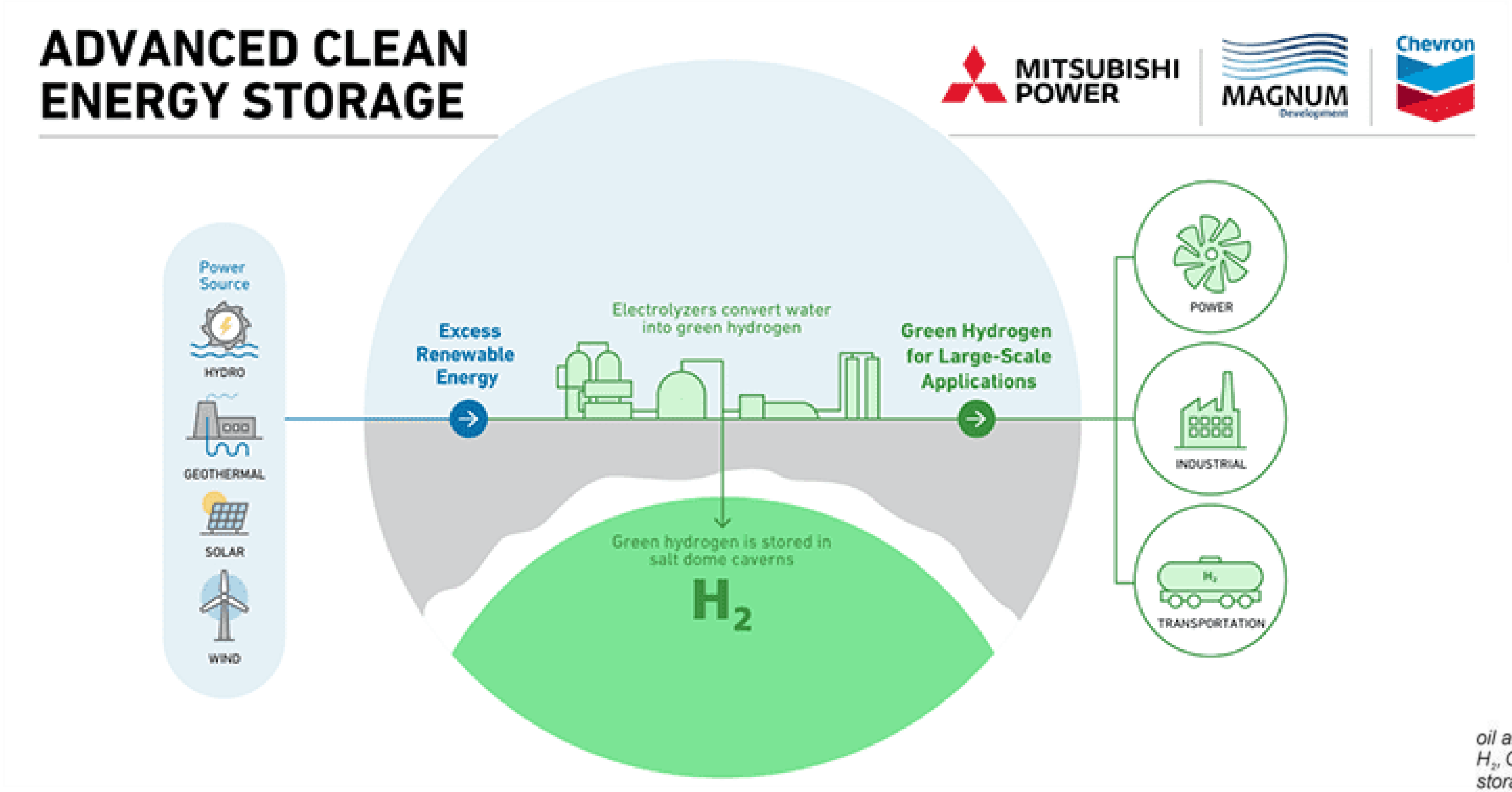


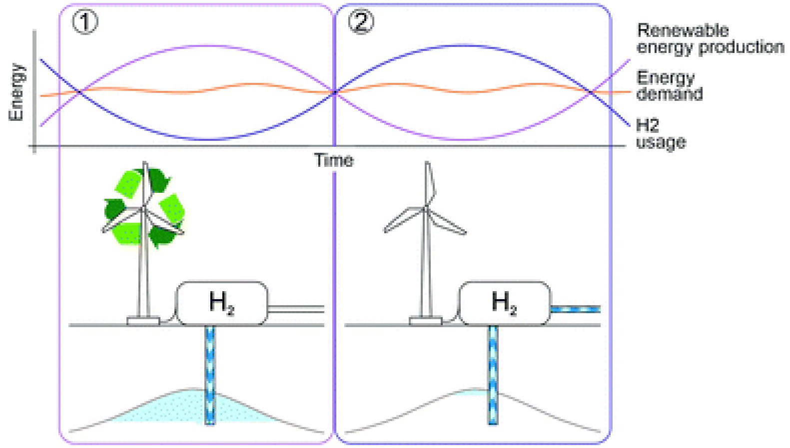
ŪDEŅRAŽA RISINĀJUMI

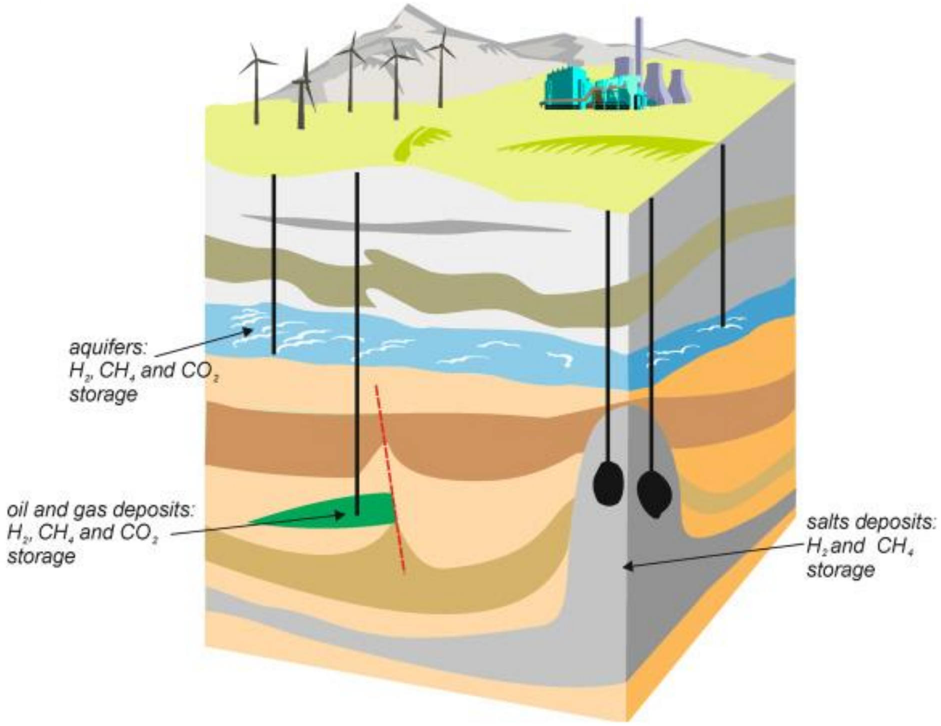




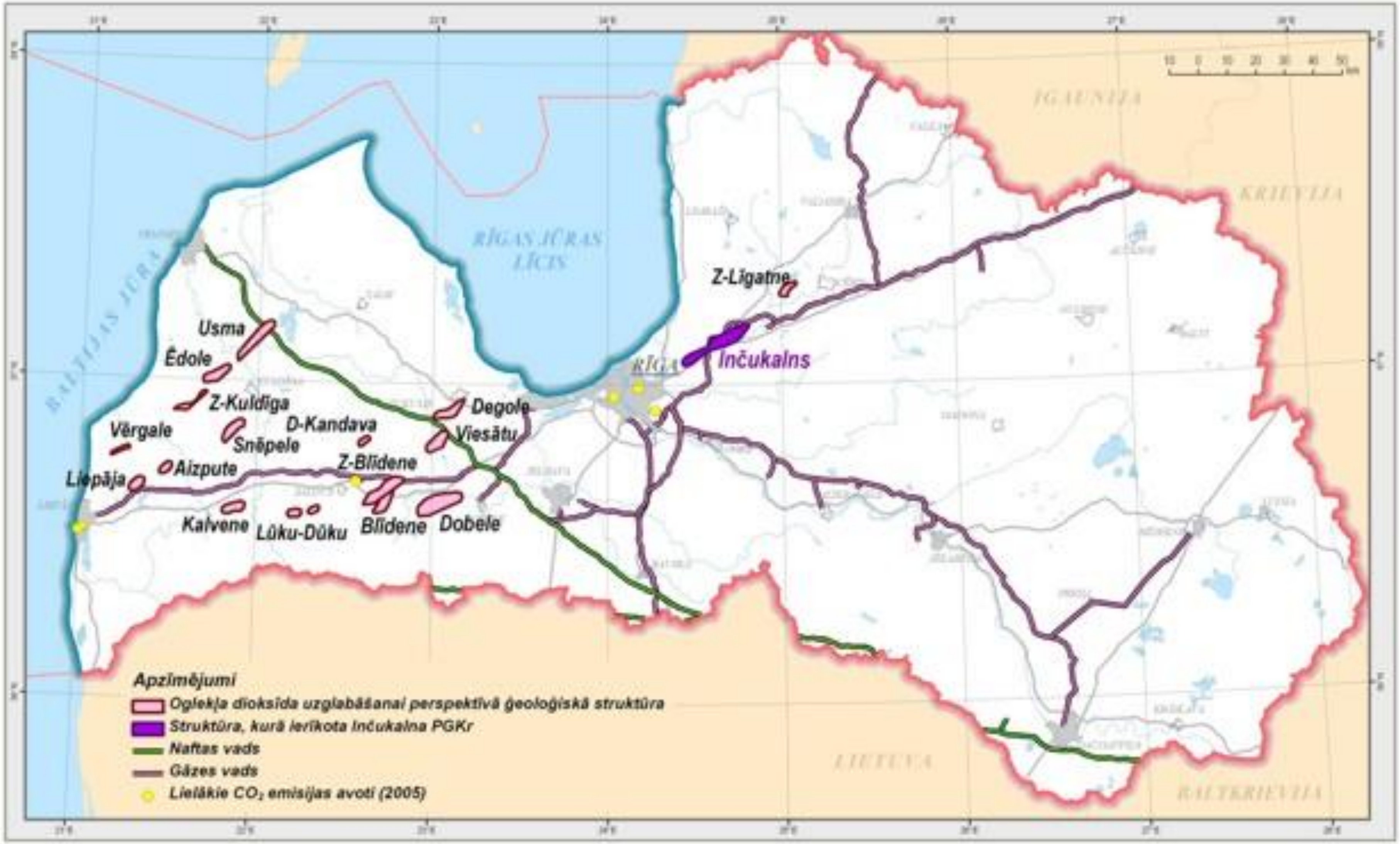
ŪDEŅRAŽA RISINĀJUMI



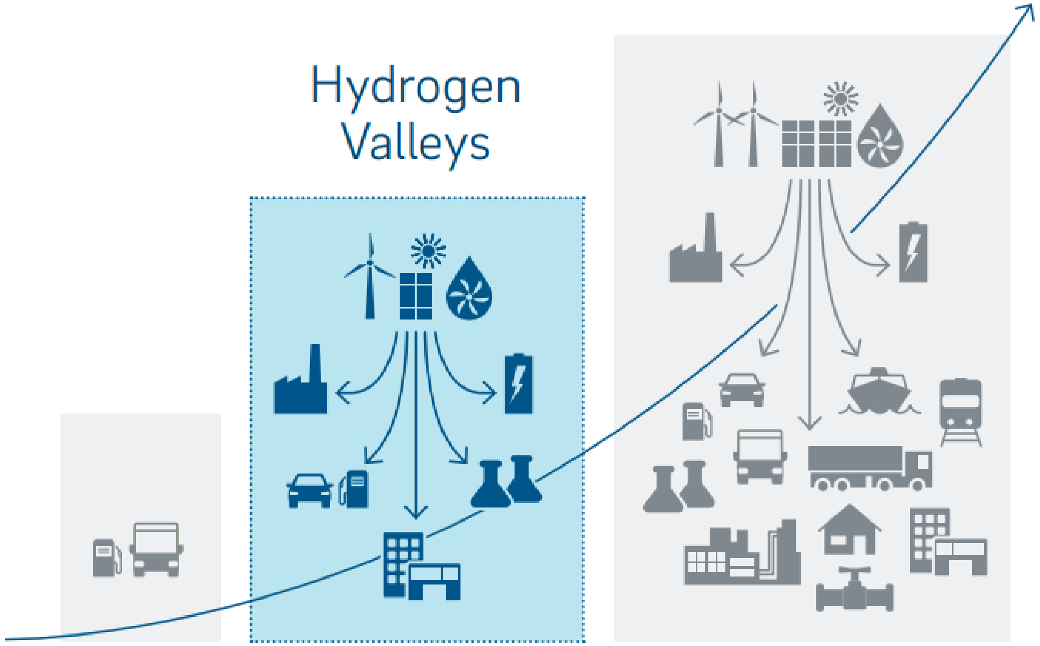




VAI LATVIJĀ IR IESPĒJAS?



KĀ IESTARTĒT ŪDEŅRAŽA EKONOMIKU?



KĀ IESTARTĒT ŪDEŅRAŽA EKONOMIKU?

United Kingdom
→ HyNet North West England
→ BIG HIT Orkney Islands

Netherlands
→ HEAVENN
→ Hydrogen Delta
→ H2 Proposition Zuid-Holland/Rotterdam[1]
→ Port of Amsterdam region[1]

Germany
→ H2Rivers/ H2Rhein-Neckar
→ HyBayern
→ Norddeutsches Reallabor
→ eFarm
→ Hyways for Future

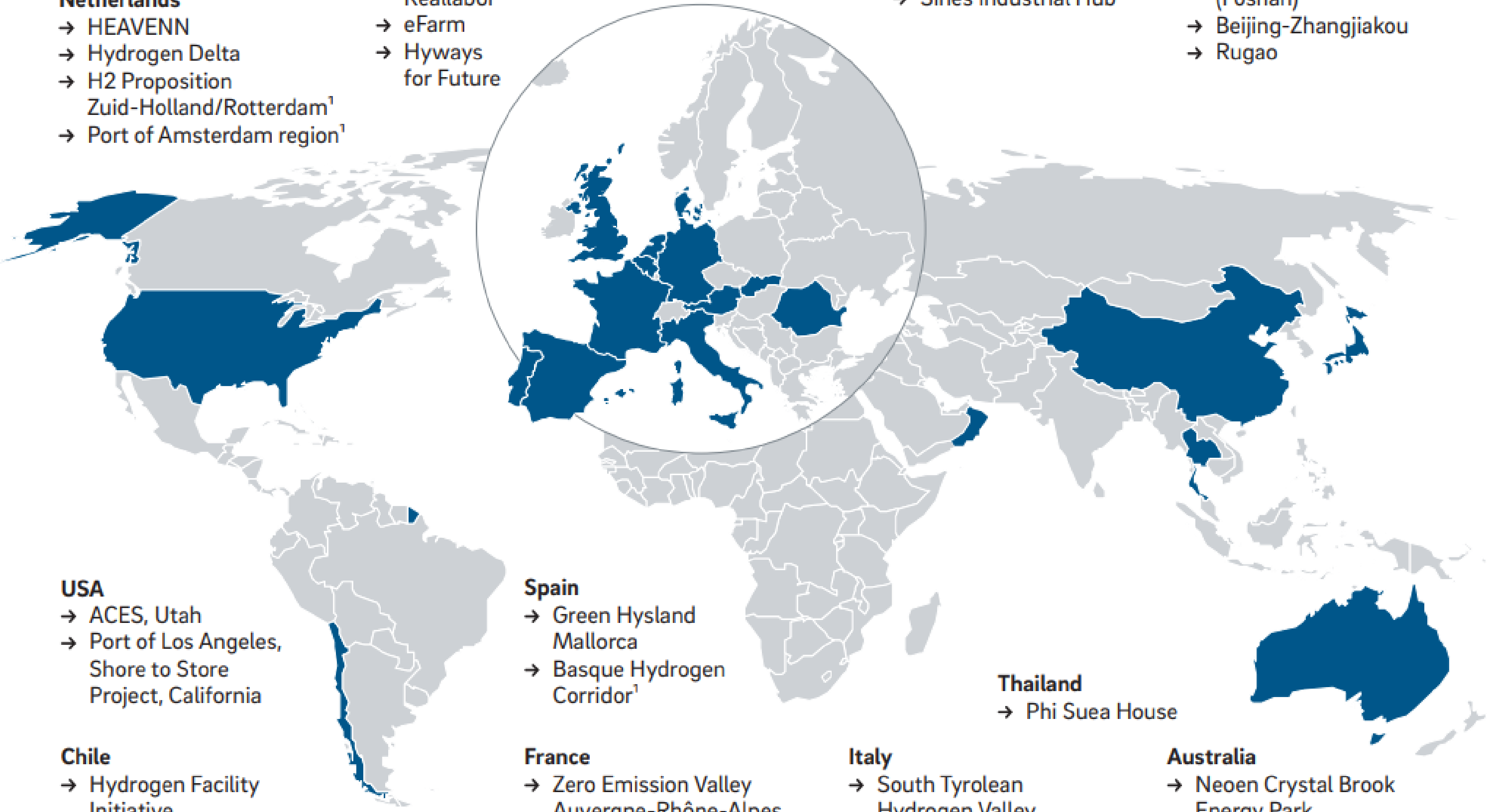
Denmark
→ HyBalance

Austria
→ WIVA P&G

Europe [IPCEI]
→ Blue Danube
→ Black Horse
→ Green Octopus
→ Green Crane
→ Sines Industrial Hub

Japan
→ FH2R Fukushima

China
→ Pearl River Delta (Foshan)
→ Beijing-Zhangjiakou
→ Rugao



USA
→ ACES, Utah
→ Port of Los Angeles, Shore to Store Project, California

Chile
→ Hydrogen Facility Initiative

Spain
→ Green Hysland Mallorca
→ Basque Hydrogen Corridor[1]

Thailand
→ Phi Suea House

France
→ Zero Emission Valley Auvergne-Rhône-Alpes
→ Normandy Hydrogen Deployment Plan
→ Hydrogen Territory Bourgogne Franche Comté
→ CEOG, French Guiana

Italy
→ South Tyrolean Hydrogen Valley

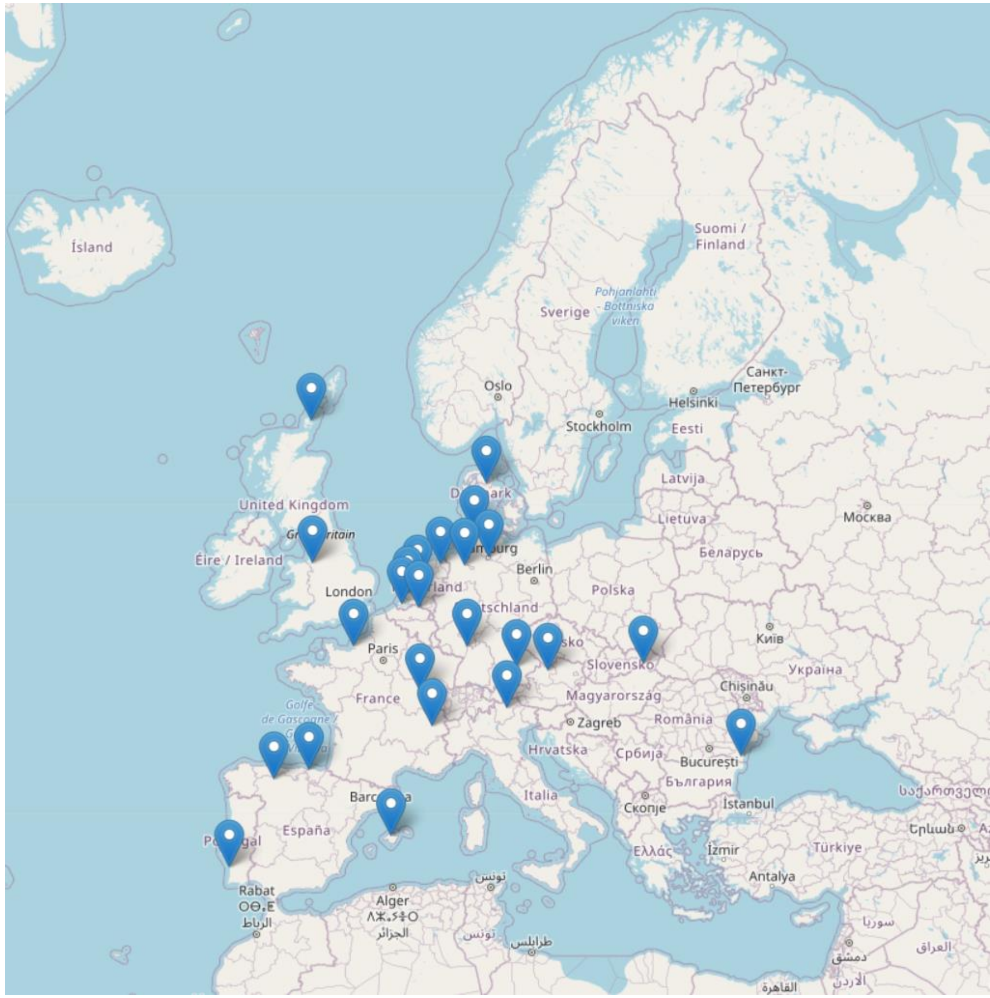
Oman
→ Green Hydrogen & Chemicals Oman[1]

Australia
→ Neoen Crystal Brook Energy Park
→ Eyre Peninsula Gateway

36
Hydrogen Valleys

20
Countries

32,541
Total investment (M€)



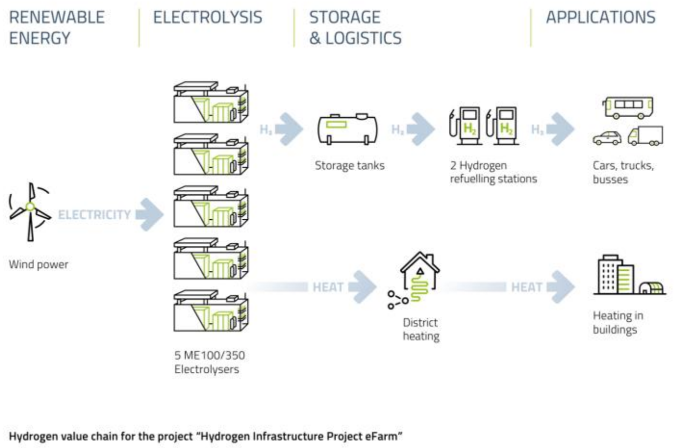
KĀ IZSKATĀS ŪDEŅRAŽA IELEJA?

E-FARM (VĀCIJA – ZIEMEĻ FRĪSIJA)

eFarm projekts nodrošina 100% «zaļo» vietējās izcelsmes H2, kurš ir ražots no vēja un saules enerģijas. Šī vietējā apgāde rada iespējas kompānijām un pilsoņiem iegādāties H2 transporta līdzekļus.

- 5 H2 ražotnes - elektrolīzeri (1.125 MW kopējā jauda) izvietotas netālu no esošajiem vēja parkiem
- 2 H2 uzpildes stacijas
- 2 H2 degšunu sabiedriskie autobusi
- 30 H2 degšūnu vieglie auto

- Projekta ieviešana: 03/2017 – 2022
- Satuss: darbojās (kopš 11/2020)
- Kopējais budžets: 16 M€
- Nacionālais finansējums: 8.0 M€



https://energie-fr-de.eu/fr/manifestations/lecteur/conference-sur-stockage-comme-vecteur-de-flexibilite-pour-la-transition-energetique.html?file=files/ofaenr/02-conferences/2019/190925_conference_stockage_flexibilite/Presentations/09_Andre_Steinau_GP_Joule_DFBEW_OFATE.pdf


NĀKOTNES VĪZIJA:
VENTSPILS REĢIONS – ZAĻĀS ENERĢIJAS UN KLIMATNEITRĀLA BIZNESA IESPĒJU CENTRS
H_2
SAF
BIO & E-DEGVIELA
H_2/CO_2
H_2 / E-METANOLS
ZAĻAIS AMONJAKS
RE-ELEKTRIFIKĀCIJA
KURZEMES LOKS
INDUSTRIJA
TRANSPORTS
DZĪVOJAMAIS RAJONS
H_2 / CO_2 ĢEOLOĢISKĀ UZGLABĀŠANA
CO_2 MAĢISTRĀLAIS CAURUĻVADS
H_2 MAĢISTRĀLAIS CAURUĻVADS
LOKĀLAIS CAURUĻVADS

ATKRITUMI

H2 UN SINTĒTISKĀS DEGVIELAS

Kompānijas RavenSR tehnoloģija ļauj pārstrādāt:

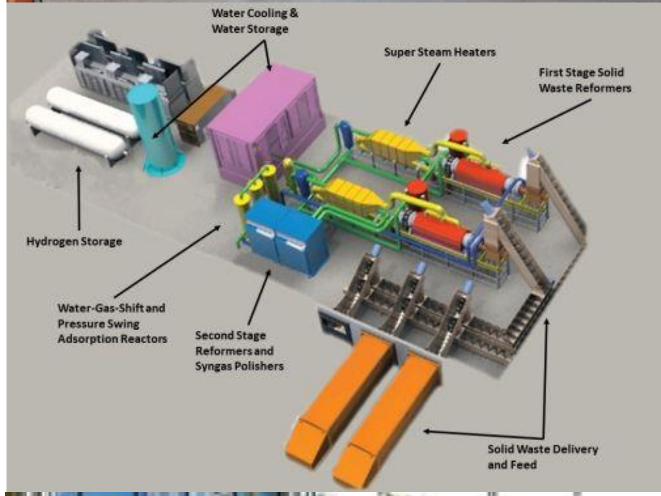
- Municipālos sadzīves atkritumus (MSW)
- Bioloģisko (ēdiena) atkritumus,
- Biomasa (koksnes) atkritumus,
- Medicīniskos atkritumus,
- Izgāztuvju gāzi (metānu),

ar Tvaika / CO2 reformēšanas tehnoloģiju (augstas temperatūras termālā pārstrāde ar bez-sadegšanas tehnoloģiju) un ražot:

- Ūdeņradi,
- Sintētiskās degvielas:
  - Dīzeļdegvielu,
  - Aviācijas degvielas (Jet A, Jet B, JP-8)

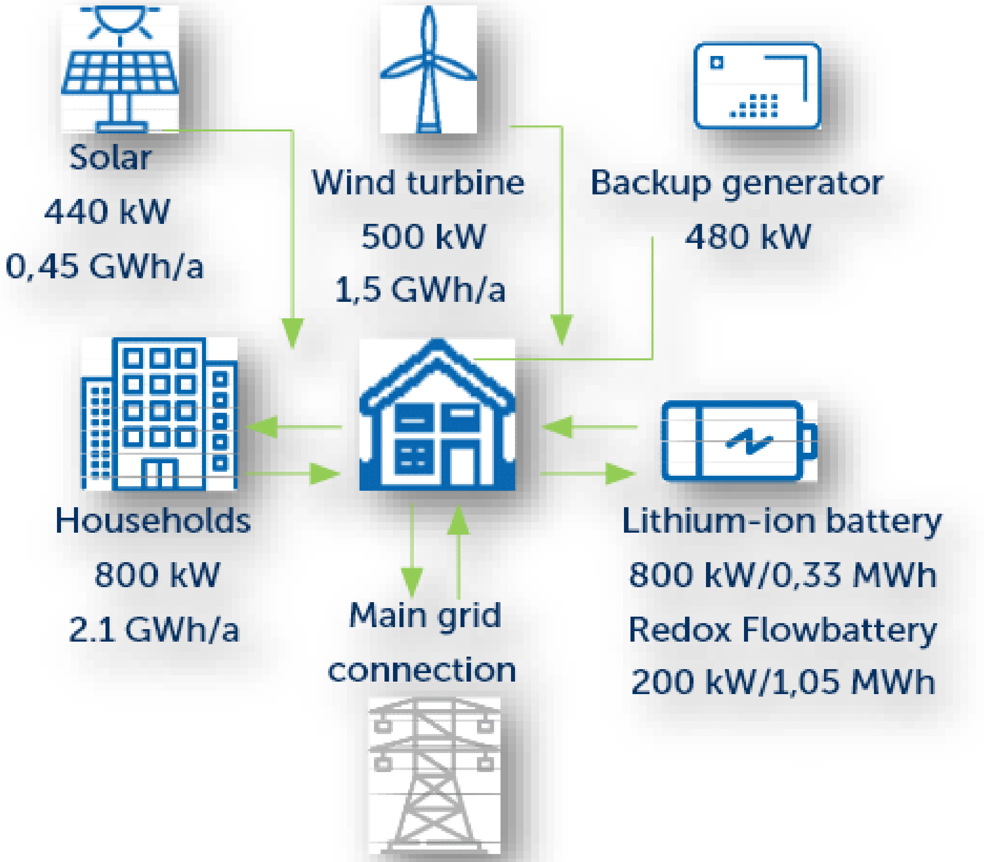
50 T ATKRITUMU => 4,5 T/H2 DIENĀ

~ 100 SMAGO AUTO H2 PATĒRIŅŠ



DECENTRALIZĀCIJA - ENERGOKOPIENAS

SIMRIS (ZVIEDRIJA)

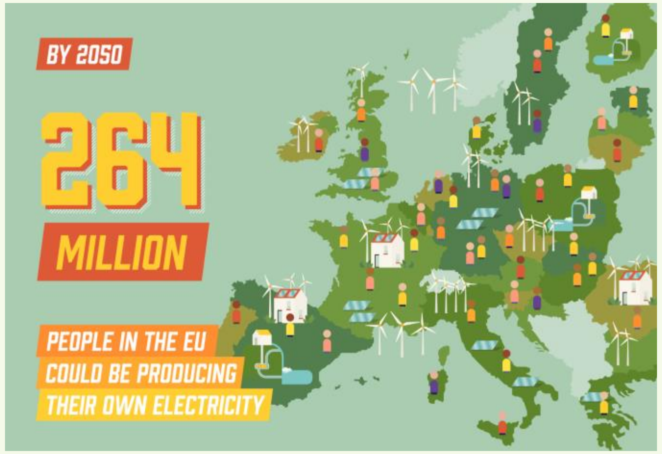


https://www.youtube.com/watch?v=p1PFfv73nnU
https://we-blog.eon.com/en/we-blog/simris.html
https://interflex-h2020.com/interflex/project-demonstrators/sweden-simris/

DECENTRALIZĀCIJA - ENERGOKOPIENAS

https://vimeo.com/394946893

ENERGOKOPIENAS



SAITES

COME-RES:

https://come-res.eu/

RESCoop:

https://www.rescoop.eu/

SCORE:

https://www.score-h2020.eu/

Compile:

https://www.compile-project.eu/

PALDIES!

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https://www.linkedin.com/in/kaspars-liepins-33442142/